TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 252

RESISTANCE OF A FIFTEEN-CENTIMETER DISK

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Summary

The results of this test show that the dynamic scale has very little effect on the drag coefficient of a disk over a wide range of Reynolds Number. A comparison of these results with those of tests made on a series of disks at Göttingen University furnishes a good check on the method of testing in this tunnel.

Introduction

A 15-centimeter disk was tested in the variable density wind tunnel of the National Advisory Committee for Aeronautics, for the purpose of comparing results from this tunnel with those of other tunnels. The drag coefficient was determined for a series of tank pressures ranging from 1 to 20 atmospheres. The results check very well with those of the Göttingen tests.

Method

The disk used was made of steel, 15 cm (5.91 in.) in diameter on the face. The edges were chamfered back, leaving a sharp edge at the face. The method of support is shown in Fig. 1. A threaded fitting which was brazed to the center of the disk, was screwed on to a 3/8 in. (.953 cm) rod about 11 in. long. This rod was threaded into a 3/4 in. (1.905 cm) rod 7 in. long, which in turn was mounted on the angle of attack bar carried on the tunnel balance. For a description of the tunnel and the balance mechanism see Reference 1. The support drag was measured, after disconnecting the disk from the supporting spindle and suspending it from the tunnel well by means of 4 wires. Clearance was left between it and the 3/8 in. (.953 cm) rod, so the only forces transmitted to the balance were those on the supporting rods. The net drag of the disk was found by subtracting this support drag from the combined drag of the disk and support.

Results

Table I gives the tank pressure, dynamic pressure, Reynolds Number and drag coefficient of the disk for the points taken. Fig. 2 shows graphically the variation of drag coefficient with Reynolds Number. On the same scale are plotted points from tests made at Göttingen University, see Reference 2.

The results show very good agreement between the two tunnels. They indicate that there is very little scale effect on the drag coefficient of a disk, although there seems to be a slight decrease in drag coefficient with increasing Reynolds Number.

Table I.

Model - 15 cm (5.91 in.) Disk. Area - .0177 m^2 (.1905 sq.ft.).

Tank Pressure Atmos. Abs.	Dynamic Pressure "q" kg/m^2	Dynamic Pressure "q" lb./sq.ft.	Reynolds Number	Drag Coefficient
1.00	28.10	5.75	210,000	1.[illegible]18
2.48	71.75	14.70	523,000	1.139
5.10	154.00	31.54	1,090,000	1.120
9.93	324.00	66.36	2,190,000	1.100
19.93	699.00	143.17	4,440,000	1.088
18.71	654.00	133.95	4,200,000	1.077
15.43	523.00	107.12	3,460,000	1.108
10.53	340.00	69.64	2,340,000	1.100
4.96	150.80	30.89	1,080,000	1.113
2.58	77.10	15.79	560,000	1.124
1.00	28.60	5.86	214,000	1.083

$RN = \frac{\rho V d}{\mu}$ where d = diameter of disk.

References

1. Munk, Max M. and Miller, Elton W. : The Variable Density Wind Tunnel of the National Advisory Committee for Aeronautics, Part II. Technical Report No. 227 - 1926.

2. Prandtl, L. : Ergebnisse der Aerodynamischen Versuchsanstalt zu Göttingen. II Lieferung, 1923.

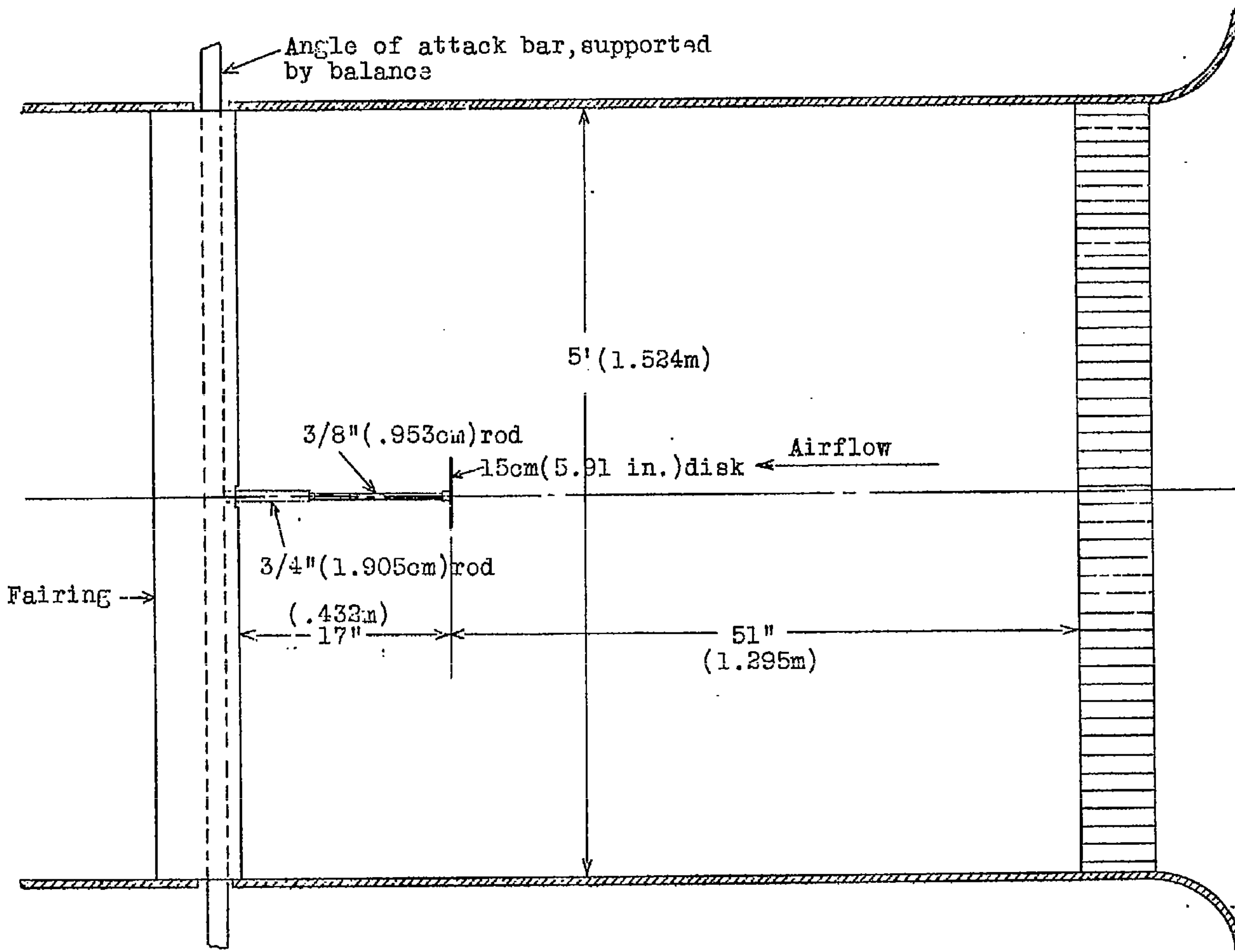

Fig.1 Test section of tunnel.

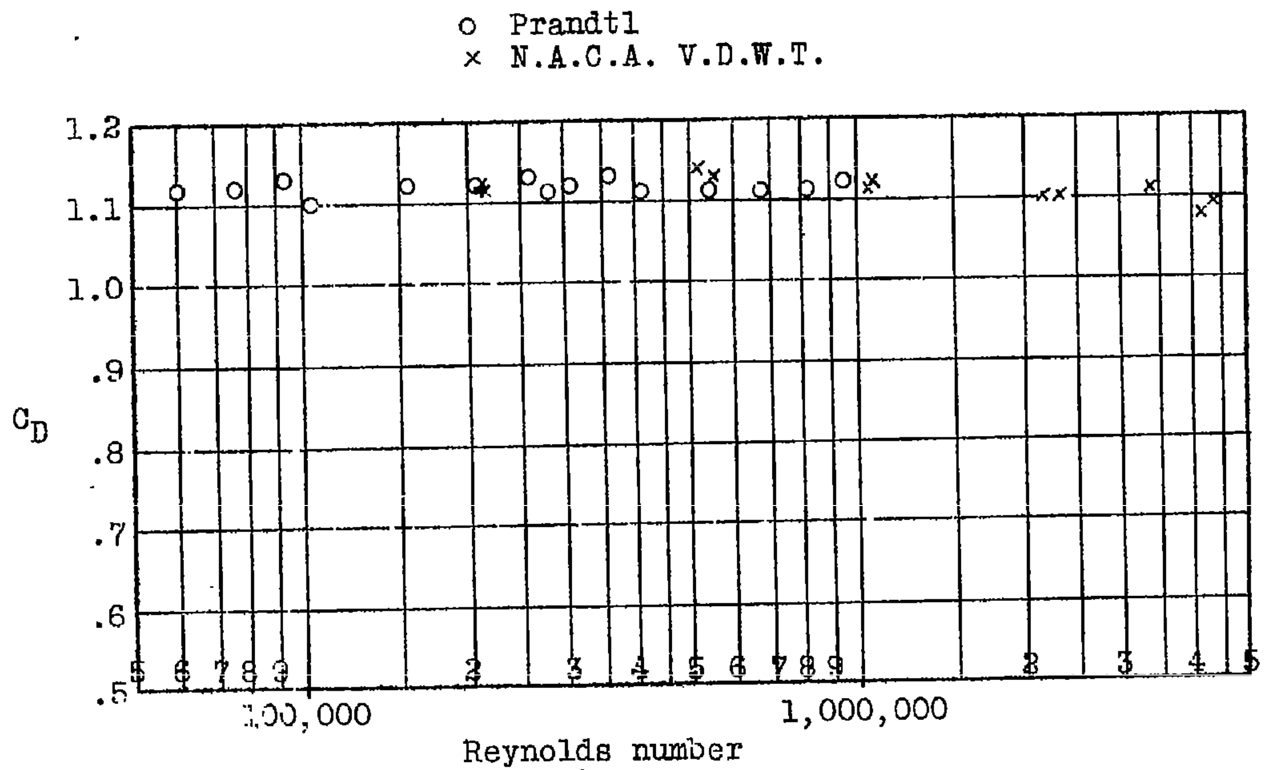

Fig.2 Drag coefficient of a 15 cm(5.91 in.)disk.